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GEOGRAPHICAL VARIATION IN *SCINTHARISTA NOTABILIS* (WALKER 1870) (ORTHOPTERA, ACRIDIDAE)

By B. P. Uvarov, D.Sc., F.R.E.S.

(*Imperial Institute of Entomology.*)

The Oedipodine genus *Scintharista* was established by Saussure (1884, *Prodr. Oedipod.* : 121) for *S. brunneri* Saussure 1884, *Oedipoda venusta* Fieber 1853 and *Oedipoda wagneri* Eversmann 1859, but the same author in 1888 (*Addit. Prodr. Oedipod.* : 36) removed the two last-named species to the genus *Microscirtus* Saussure (a misprint for *Mioscirtus* Saussure, *loc. cit.* : 18, 175), leaving only *S. brunneri* as the available genotype. An obvious synonym of *Scintharista* is *Quiroguesia* I. Bolivar (1886, *Ann. Soc. esp. Hist. nat.* **15** : 515) based on *Acridium miniatum* Brullé 1842; this has already been pointed out by me (Uvarov, 1922, *J. Bombay nat. Hist. Soc.* **28** : 360), when I also attempted to elucidate the geographical variation of the species and recognised two subspecies. Since then large series of specimens from the whole distribution area of the species have accumulated in my hands, and their critical study has enabled me to present the following revision of the species and its geographical races.

The geographical variation of *S. notabilis* involves the coloration of the disc of hind-wings and the width of their dark fascia; the pattern of the elytra; and the coloration of hind tibia, while additional characters are sometimes found in the relative measurement of parts, etc. While a general discussion of the variation will be offered after the descriptive part of the paper, the following definitions are necessary in order to make the descriptions clear.

Wing fascia. The width of the dark fascia of the wing varies appreciably between subspecies, while remaining reasonably constant in the same sex, and sometimes in both sexes, of a subspecies. For diagnostic purposes, it appears useful to measure the width of the fascia where it is intersected by the anal vein (Saussure), or vena dividens (Snodgrass 1929, *Smithson. misc. Coll.* **82**(2) : 85, fig. 45, VD) the apex of which marks the posterior end of the first lobe of the wing. The width of the fascia is then expressed as a decimal fraction of the length of the vein.

Elytral pattern. This consists mainly of the alternating dark (black, brown, or greyish-ochraceous) and light (white, or hyaline) transverse fasciae. Their position and sequence are as follows :—

First dark (D.1). Base of the elytron to the middle of the discoidal area. Usually spotted with lighter colour, and sometimes its proximal part lighter than the distal.

First light (L.1). Very narrow, white and sharply delimited in the darker coloured subspecies, but broader, light-buff and imperfectly delimited in the lighter subspecies. Sometimes becomes obsolete, with the result that D.1 and D.2 form a single very large fascia.

Second dark (D.2). Apical third of the discoidal area and a little distance beyond its apex. Usually more sharply delimited distally than proximally. Sometimes (see above) not separated from D.1.

Second light (L.2). Separating D.2 from D.3. Practically always distinct, both the membrane and the vein and veinlets within its limits being white, or whitish. Usually better delimited proximally than distally.

Third dark (D.3). In the middle of the post-discoidal half of the elytron. Present as a definite fascia only in the darkest forms, but mostly indicated only by more or less confluent small brown spots, or brown-bordered cells.

Third light (L.3). Preapical in position, separating D.3 from D.4. Hyaline, broad and with indefinite outlines even in the darkest subspecies.

Fourth dark (D.4). On the apex, occupying the whole of it in the darkest subspecies or split up into small spots and eaving the apical edge clear in the lighter ones.

Key to subspecies.

1(10). Disc of hind-wings red, of various shades. Wing fascia narrow (0·11–0·14; plate 1, figs. A, B, D).

2 (3). Hind tibia ivory-white, without trace of reddish. Elytra (plate 1, fig. B): L.1 very weak, or absent; D.1 and D.2 fused, making the whole basal half of elytron light dusty-brown, with small spots of lighter shades; L.2 broad; D.4 weak, split up into small spots. Wings: disc light-red, tending to fade out on the anal margin.—Eastern Iran (Khorasan); Baluchistan; N.W. India . . . . 3. *pallipes* subsp. n.

3 (2). Hind tibia orange-yellow to light-red.

4 (9). Wings: disc without bluish tinge near the anal margin. Elytra (plate 1, fig. A): L. 1 very weak, but usually perceptible.

5 (8). Larger, more slender, and scarcely rugulose. Frontal ridge in profile almost straight, forming a distinct angle with the vertex; pronotal carina not convex in profile (fig. 1, N). Hind femur narrow, four times as long as its maximum width. Hind tibia orange-red, fading to yellowish basally, but without a distinct postbasal ring.

5 (7). Wings: disc light-red.—Canary Islands; Morocco; Algeria; Tunisia; S. Spain . . . . . 1. *notabilis* (Wlk.).

7 (6). Wings: disc brick-red.—Anglo-Egyptian Sudan; Somaliland. 2. *lateritia* subsp. n.

8 (5). Smaller, more robust, distinctly rugulose. Frontal ridge in profile convex, forming a wide arch with the vertex; pronotal carina convex in profile (fig. 1, C). Wings: disc rose-red. Hind tibia light-red, with a distinct white postbasal ring.—India (Cutch peninsula) 4. *cinctipes* subsp. n.

9 (4). Wings: disc light-red, with distinct bluish tinge near the anal margin; the anal portion with alternating red (anal, raised) and bluish (intercalate, sunk) veins. Elytra (plate 1, fig. D): L.1 absent; D.1 and D.2 fused, forming a continuous brownish area, with small lighter spots, occupying the basal half of the elytron; D.3 absent and D.4 either absent or very weak, so that the whole distal half of the elytron is hyaline, with irregularly scattered small brownish spots, or brown-margined cells. Hind tibia reddish-orange, fading to white basally.—Arabia; Palestine . . . . . 5. *blanchardiana* (Sauss.), ♂.

10 (1). Wings: disc yellow; fascia broad (0·16–0·20; plate 1, figs. C, E, F).

11(12). Wings: disc pale greenish-yellow, becoming bluish close to the anal margin; fascia very broad (0·20). Elytra (plate 1, fig. C): L.1 absent; D.1 and D.2 fused and occupying the basal half of the elytron; D.3 and D.4 absent, the whole distal half being hyaline, with small scattered brown spots. Hind tibia orange-red, with not sharply defined whitish postbasal ring.—Arabia; Palestine 5. *blanchardiana* (Sauss.), ♀.

12(11). Wings: disc intense lemon-yellow, without bluish tinge near the anal margin; fascia broad (0·16). Elytra (plate 1, figs. E, F): all fasciae well defined. Hind tibia without trace of red.

13(14). Elytra (plate 1, fig. E): all fasciae distinct, but not sharply delimited; dark fasciae more or less spotted with light. Hind tibia dirty-white.—N.W. Iran (Shahrud); Chitral; Kashmir (?) 6. *brunneri* (Sauss.).

14(13). Elytra (plate 1, fig. F) : all fasciae very sharply delimited, the dark ones being almost black, without lighter spots, and the light ones white. Hind tibia honey-yellow.—Araxes valley . . 7. *miramae* susbp. n.

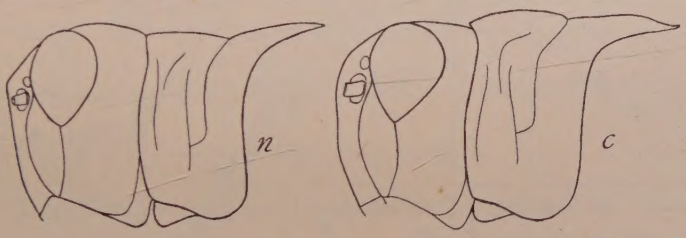
Measurements of subspecies in mm.

	Body		Elytra		Wing fascia (index)		Hind femur	
	♂	♀	♂	♀	♂	♀	♂	♀
notabilis . .	23–29	33–37	22·5–27	31–35	0·12	0·14	12·5–15	17–19
lateritia . .	24–28	33–39	25–27	34–37	0·12	0·14	14–15	17–19
pallipes . .	25–30	36–40	25–31	34–38	0·12	0·13	14–16	18–20
cinctipes . .	22	30	24	28	0·11	0·13	14	16
blanchardiana .	26–28	39–42	25–28	38–41	0·11	0·20	13–15	19–23
brunneri . .	26	38	27	39	0·16	0·17	15	19
miramae . .	25–27	38	28	40	0·16	0·17	14	19

Annotated List of Subspecies.

1. *S. notabilis notabilis* (Walker 1870), plate 1, fig. A; text-fig. 1, N.

1840. *Acridium miniatum*, Brullé *in* Webb et Berthelot, *Hist. nat. Isles Canar.* **2** (2), *Entom.* : 78, pl. 5, fig. 13
1870. *Oedipoda notabilis*, Walker, *Cat. Derm. Salt. Brit. Mus.* **4** : 745.
1884. *Oedipoda brullei*, Saussure, *Prodr. Oedipod.* : 148, 153.
1886. *Quiroguesia miniata*, I. Bolivar, *An. Soc. esp. Hist. nat.* **15** : 515.
1888. *Quiroguesia brullei*, Saussure, *Addit. Prodr. Oedipod.* : 35.



1

Fig. 1.—n, *Scintharista notabilis notabilis* (Walk.), ♂, head and pronotum in profile; c, *S. n. cinctipes*, subsp. n., ♂, ditto.

Nomenclature. The first description of the species and of the Canarian subspecies is by Brullé and dates from 1840 (not 1842, as usually given; *cf.* Sherborn, *Index Anim.* **2** : 4071). Unfortunately, the combination *Acridium miniatum* used by Brullé had already been previously employed by Fischer-Waldheim (1822, *Entomogr. Imp. Russ.* **1** : 38, pl. 1, fig. 2) for the insect called by him *Acrydium miniatum* Pallas, now *Oedipoda miniata* (Pallas 1771). This makes *miniatum* of Brullé a homonym in the genus *Acridium* (unless an ultra-formal view of the different spelling of the generic name in the two cases is taken) and the international rules, as they now stand, do not permit the retention of Brullé's name. Saussure (1884, *loc. cit.*) rejected the name *miniatum* Brullé because he thought this was a misuse of *miniatum* Pallas (*cf.* Saussure, 1888, *loc. cit.* : 35, footnote), while actually Brullé used it as a name for his own species by calling it " *Acridium miniatum*, Br." as in the case of all his new species. Saussure's name, *brullei*, however, is in any case antedated by *notabilis* Walker.

Description. Relatively robust, and short-winged. Elytra: D.1 and D.2 almost fused, L.1 being very weak; D.3 and D.4 absent or weak, and the whole distal half of elytron is hyaline, with small brown spots, or brown-margined cells. Wings: disc light-red; fascia narrow. Hind tibia orange-yellow.

Type locality. *Acridium miniatum* Brullé—Canary Islands; *Oedipoda notabilis* Walker—" Sandwich Islands," but this is a case of mislabelling (*cf.* Uvarov, *Trans. ent. Soc. Lond.* **1925** : 299) and the type was certainly from the Canary Islands, probably from Teneriffe, which I here select as the type locality.

Distribution. Canary Islands: Teneriffe; Gran Canaria; Las Palmas; Gomera (see Willemse 1936, *Natuurhist. Maandbl.* **25** : 102, where previous references are given). Morocco: Sidi Ifni (I. Bolivar 1935, *Eos* **11** : 404); Marrakesh; Agadir (I. Bolivar 1914, *Mem. Soc. esp. Hist. nat.* **8** : 188). Algeria: Col de Sfa, near Biskra (Finot 1895, *Ann. Soc. ent. Fr.* **64** : 446); Bou-Saada, 8–10.x.1937; Biskra, 19.vii.1934 (*M. N. Korsakoff*). Tunisia: Gafsa (*G. C. Champion*). Spain: Sevilla (I. Bolivar 1898, *Ann. Soc. Sci. nat. Porto* **5** : 72, *sep. repr.*).

Algerian specimens are somewhat larger than the Canarian ones and have, generally, better pronounced L.1 fascia on the elytra. I have not seen any Spanish specimens.

2

Fig. 2.—Distribution of subspecies of *S. notabilis* (Walk.).

2. **S. notabilis lateritia** subsp. n.

Description. Does not differ from *S. n. notabilis*, except in the colour of the wing disc which is brick-red, instead of light-red.

Type locality. British Somaliland, Long. 42° 50′ E., Lat. 10° 35′ N., 4500 ft.

Distribution. Anglo-Egyptian Sudan: Jebel Teiga, N. Darfur, ix.1934, 3 ♀♀; Khor Tameik, 30.ix.32, 1 ♂ (*R. C. M. Darling*); Shendi, Ben Naga, ix.1931, on rocky ground on hill-side, 1 ♀ (*H. B. Johnston*). Erythrea: Massowah, 1 ♀. British Somaliland: Somali, 1 ♀ (*Miss P. Gillet*); Long. 45° 50′ E., Lat. 10° 35′ N., 4500 ft., rocky and stony ground, practically no vegetation, 33 ♂♂ (including the type), 14 ♀♀ (*R. H. Taylor*).

3. **S. notabilis pallipes** subsp. n., plate 1, fig. B.

Description. Differs from *S. n. notabilis* by somewhat larger size, relatively longer elytra, wide and white L.2, better defined D.3, but particularly by the ivory-white hind tibia, without any trace of reddish colour.

Type locality. British Baluchistan, Gwal, 6000 ft.

Distribution. E. IRAN: Khorasan province, 1928, 1 ♂ (*Ofshar*). BRITISH BALUCHISTAN: Ormara hill, 14.v.1933, "frequent," 1 ♂; Shahrig, Sibi district, 30.vii.1931, 1 ♀ (*M. Sharif*); Mach, Bolan pass, 3000 ft., 27.ix.1930, 1 ♂, 2 ♀♀ (*W. H. Evans*); Pechi, 7500 ft., 1.vi.1931, 1 ♀; Gwal, 6000 ft., iv.1931, 1 ♂, type (*D. Harrison*). NORTH-WESTERN FRONTIER PROVINCE, INDIA: Malakand, 1 ♀ (*A. Begbie*). PUNJAB: Khewra, Salt Range, 24.ix–x.30, 7 ♂♂, 7 ♀♀; Kallar Kohar, Salt Range, 20–21.x.30, 1 ♂; Choa, 10 m. from Keura, 15–21.x.30, 1 ♂, 1 ♀ (*S. L. Hora* and *H. S. Pruthi*); Campbellpur, vii.1885, 1 ♀.

4. **S. notabilis cinctipes** subsp. n., text-fig. 1, C.

Description. This may well be considered a distinct species, as it differs from all other subspecies in smaller size, but more robust habitus, in frontal ridge more rounded in profile, in convex and rugulose pronotum, and in short and broad hind femur. In the elytral pattern there is a close agreement with *S. n. notabilis*, while the wing disc is bright rose-red. Hind tibia is light-red, with well-defined white postbasal ring.

Type locality. Nirwan, Pachham Islds., Cutch, W. India, x.1935, 2 ♂♂, including the type, 1 ♀ (*C. McCann*).

A paratype will be deposited in the museum of the Bombay Natural History Society.

5. *S. notabilis blanchardiana* (Saussure 1888), plate 1, figs. C and D.

1888. *Quiroguesia brullei* var. *blanchardiana* Saussure, *Addit. Prodr. Oedipod.* : 35.

Description. This subspecies is remarkable for a striking sexual dimorphism. The male is very similar in size and coloration to *S. n. notabilis*, except that the wing disc is of a paler shade of red and becomes distinctly bluish close to the anal margin, while hind tibia is orange-red. The female, on the other hand, is relatively very large and long-winged, with the wing base pale yellow becoming bluish close to the anal margin, and the wing fascia relatively very broad; hind tibia as in the male. Elytral pattern in both sexes is characterised by the absence of L.1, L.2, D.3 and D.4, so that the elytron is divided into two parts, the whole basal half being greyish-brown, and the apical half hyaline, with few small brown-margined cells; sometimes there is a condensation of such cells near the apex forming an incomplete D.4.

Type locality. Saussure has described this insect from Bombay (Paris Museum; probably, a case of mislabelling) and Aden (British Museum), and I select here one female in the British Museum labelled Aden, as the type.

Distribution. ARABIA: Hedjaz, Yemen, Aden, Lahej, Muscat. PALESTINE: Aingeddi, Wadi Kelt, Jerusalem.

Palestine specimens are somewhat smaller than the Arabian ones.

6. *S. notabilis brunneri* (Saussure 1884), plate 1, fig. E.

1884. *Scintharista brunneri* Saussure, *Prodr. Oedipod.* : 121 (*partim*).

Description. This and the following subspecies form a very distinctive group, characterised by slender habitus and wings yellow in both sexes, with a broad fascia. The present subspecies has the elytra with all light and dark fasciae distinct, but not sharply defined, and differs from the following also in dirty-white hind tibia.

Type locality. Described by Saussure from mixed material, originating from Shahrud in the Elburs mountains of northern Iran and from Ordubad in the Araxes valley. I designate Shahrud as the type locality of this subspecies, while the Ordubad specimens should be referred to the next one.

Distribution. Iran: Shahrud, 1 ♂, 1 ♀ (*A. N. Kiritshenko*). North-Western India: Chitral, 20–28.vi.29, 2 ♂♂; Shishi river, between Tar and Drosh, Chitral, 6–10.ix.29, 3 ♂♂ (*B. N. Chopra*). Kashmir: Hunza, N. Kashmir, 7500 ft., 29.viii.13, 1 ♀ (*R. W. G. Hingston*).

The Kashmir female is referred here with some hesitation, as it has less distinctly fasciated elytra and has lost its hind tibiae; it may represent a distinct subspecies, but more material is necessary to decide the point.

7. **S. notabilis miramae** subsp. n., plate 1, fig. F.

1884. *Scintharista brunneri* Saussure, *Prodr. Oedipod.* : 121 (*partim*).

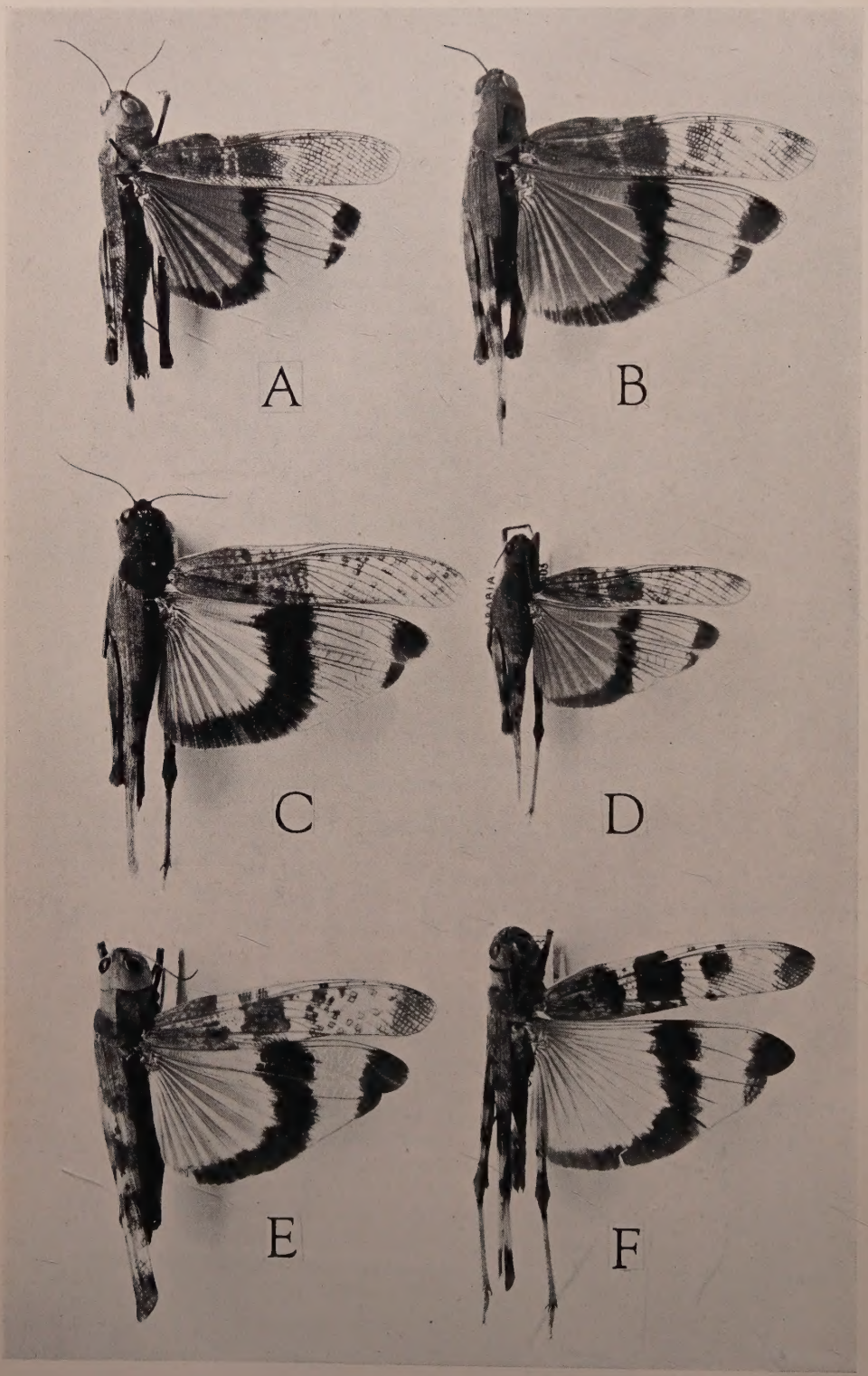
Description. Miram has already remarked (1938, *Trav. Inst. Zool. Acad. Sci., Baku* **8** : 46) that the Ordubad specimens of *S. brunneri* differ from the Iranian ones by more slender habitus, more brilliant yellow wing disc and by the sharply defined and strongly contrasted elytral fasciae, the dark ones being almost black, while the light are pure white. Hind tibia is also of a darker shade than in the typical subsp. *brunneri* from Shahrud. I have, therefore, much pleasure in naming this remarkable subspecies after Miss E. Miram in recognition of her expert assistance in my earliest orthopterological studies, and of her outstanding work on Palaearctic Orthoptera.

Type locality. Ordubad, Araxes valley (formerly Armenia, now Nakhichevan Republic).

Distribution. Armenia: Ordubad, 4.vii.1933, 1 ♂, type; 9.vii.1933, 1 ♀ (*D. Znoiko*); Ordubad, 1 ♂ (Vienna Museum, Brunner von Wattenwyl collection); Megry, Astazur (Makarian, 1930, *Bull. Univ. Erivan* **5** : 297).

General distribution and variation of *S. notabilis*.

It will be seen from the map (fig. 2) that the distribution area of *S. notabilis*, with all its subspecies, stretches in a latitudinal belt from the Canary Islands to north-western India. This belt is, however, very discontinuous and consists really of several more or less isolated areas coinciding with systems of old eroded mountains fringing the deserts of the Eremian zone. It is with this type of mountain that *S. notabilis* is connected ecologically, as it always occurs on bare stony, or gravelly slopes of strongly eroded hills, with very scanty vegetation. From the ecological point of view, *S. notabilis* should be classified as typically saxicolous (Uvarov, 1938, *Mém. Soc. Biogéogr.* **6** : 47), while from the point of view of origin, it belongs to the stock which I have called Lemurian (*tom. cit.* : 252).



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Subspecies of **Scintharista notabilis.**

The known distribution of the subspecies of *S. notabilis* is of great interest from the point of view of their respective divergence from the more primitive group, which includes the red-winged subspecies without pronounced sexual dimorphism. The first amongst them are subsp. *notabilis* and subsp. *lateritia*, which are very closely allied, but inhabit two widely separated areas of Africa. On purely ecological grounds, there are strong reasons for expecting the species to occur also in the intervening area on the isolated mountain groups such as Tibesti, Hoggar, etc., and it would be of interest to investigate in detail the respective areas of the western *notabilis*, and the eastern *lateritia*. The third subspecies of this primitive group is subsp. *pallipes* of Baluchistan and north-western India, which is separated from the other two by the Arabian peninsula, inhabitated by the very distinct and most strongly dimorphic subsp. *blanchardiana*. This latter presents exceptional interest, both zoogeographically and genetically. From the distributional point of view, it is certainly surprising to find the two sides of the Red Sea populated by two widely distinct subspecies, since the fauna of the low coastal mountain ranges is generally almost identical on the African and the Arabian sides. From the evolutionary point of view, subsp. *blanchardiana* is remarkable for its male keeping very close to the more primitive type, while the yellow-winged female represents a striking divergence from it. Since there is no evidence of any substantial environmental difference between the two sides of the Red Sea, the divergence of *blanchardiana* can only be attributed to isolation due to the formation of the Red Sea rift.

Another group of subspecies comprises the two north-eastern ones, characterised by the yellow wings of both sexes. One of them, the subsp. *brunneri*, populating Iran, Chitral and, probably, Kashmir, is fairly close to the ancestral type of elytral pattern, while subsp. *miramae*, restricted in its distribution to the Araxes valley, represents the extreme expression of the fasciated pattern.

The remaining subsp. *cinctipes*, of the Cutch peninsula in India, constitutes a group of its own. It is close to the primitive type in the pattern and coloration, but is strongly specialised in its morphology, tending in the direction of the closely allied genus *Chloebora*.

Explanation of Plate 1.

Subspecies of *Scintharista notabilis* (Walker 1870).

Fig. A. *S. n. notabilis* (Walker) 1870, ♀, Gran Canaria.
B. *S. n. pallipes* subsp. n., ♀, *type*, Baluchistan.
C. *S. n. blanchardiana* (Saussure 1888), ♀, Arabia.
D. *S. n. blanchardiana* (Saussure 1888), ♂, Arabia.
E. *S. n. brunneri* Saussure 1884, ♀, Shahrud, Iran.
F. *S. n. miramae* subsp. n., ♀, *paratype*, Ordubad, Araxes valley.

OBSERVATIONS ON CERTAIN OF THE FABRICIAN NAMES OF INDO-AUSTRALIAN RHOPALOCERA (LEPID.)

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(*British Museum* (*Natural History*)).

The evidence available for determining the identity of butterflies named by Fabricius consists of the author's published works, the Banks Collection in the British Museum, the collections of Tønder Lund, Daldorff, Sehestedt and Thott now in the Copenhagen Museum, and the unpublished Jones' *Icones*. The *Icones* depict accurate paintings of butterflies which were examined by Fabricius and are now in the Hope Department of the Museum at Oxford.

I am much indebted to the late Dr. K. L. Henriksen for granting me facilities for the study of the Copenhagen specimens during a visit to Denmark in 1933, and thanks are due also to Professor G. D. Hale Carpenter for an opportunity to study Jones' *Icones*.

Butler's *Catalogue of diurnal Lepidoptera described by Fabricius in the Collection of the British Museum* (publ. 1870, not 1869 as stated on title-page), and Watkins' paper on the butterflies of the Banks Collection (1923, *Entomologist* **56** : 204-209), have proved invaluable in the present investigation.

The published works of John Christian Fabricius (for whose autobiography, translated from the Danish by F. W. Hope, *vide* 1845, *Trans. ent. Soc. Lond.* **4** : i–xvi), containing descriptions of Rhopalocera are :—

1775, *Systema Entomologiae* (Flensburgi et Lipsiae).
1776, *Genera Insectorum* (Chilonii).
1782, *Species Insectorum* **2** (Hamburgi et Kilonii).
1787, *Mantissa Insectorum* **2** (Hafniae).
1793, *Entomologia Systematica* **3** (1) (Hafniae).
1798, *Supplementum Entomologiae Systematicae* (Hafniae).

The dates 1776 and 1782 are from the autobiography of Fabricius (*vide supra*), and differ from those given in Sherborn's *Index Animalium*, which are 1777 and 1781 respectively.

The title-page of the first volume of Jones' *Icones* bears the date 1783, the second volume is dated 1784, the third and fourth volumes 1785, and the remaining three volumes are undated. References to the *Icones* in *Ent. Syst.* **3** (1), however, show that volumes **5** and **6** must have been completed by 1791 when Fabricius last visited England. Volume **7** of the *Icones* comprises figures copied from Cramer, *Pap. Exot.*, Jablonsky, *Nat. Ins.* (*Schmett.*), etc. Almost all the specimens in the Banks Collection which are types of Fabrician names are figured in Jones' *Icones*.

A. Species Described from the Banks Collection.

As far as can be ascertained, the Indo-Australian butterflies contained in the Banks Collection were collected by Sir Joseph Banks himself, by Nelson and Bailey, who accompanied Captain James Cook on his third voyage, and by the Danes Koenig and Daldorff.

Banks accompanied Cook on his first voyage in 1769–1771, when he visited Australia, New Zealand, and Tahiti, and obtained many Queensland butterflies, and possibly a few also from Java, which were described subsequently by Fabricius. David Nelson was a Kew gardener who accompanied Cook on his third voyage in H.M.S. "Resolution" and "Discovery" (1776–1780) as a collector, his expenses being paid by Banks. Nelson sailed in the same capacity with Captain William Bligh in H.M.S. "Bounty" and, being one of the party set adrift by the mutineers, died of exposure at Timor in July 1789. William Bailey (also spelt Baily and Bayly), was engaged as an observer on H.M.S. "Discovery" on Cook's last voyage, when the ports of call of interest in the present discussion were Cape of Good Hope, Tahiti, Tonga or Friendly Islands, Hawaiian Islands, Macao and Canton, Pulau Condore, off the coast of Cochin China, and Princes Island, Java. Nelson's entomological activities are represented in the Banks Collection by butterflies from the Cape of Good Hope, the Friendly Islands, Hawaiian Islands and Pulau Condore: the only two specimens which can be attributed definitely to Bailey are the types of *Papilio peranthus* and *P. gambrisius*, which can only have been obtained from Java and Pulau Condore respectively.

John Gerard Koenig resided in South India (Tranquebar and, later, Madras), from 1768 until his death from dysentery in 1785. He is known to have been in touch with a number of European botanists (*e.g.*, Otto Thott and Martin Vahl), and he bequeathed his plants and MSS. to Banks, to whom he sent plants before his death. Koenig carried out two expeditions, one to Bangkok in Siam during 1778 and 1779, when he visited also the Nicobar Islands, Malacca, Kuala Selangor and Pulau Salang [= Junk Ceylon] in Peninsular Siam, and the second in 1779, when he collected extensively from May to July in the neighbourhood of Pulau Salang and at this time obtained the butterflies which later became the types of the Siamese species described by Fabricius. Koenig left Pulau Salang on account of illness and spent the last half of 1779 in Malacca, during which period he spent a few days at Kuala Kedah and Kuala Selangor. Koenig appears to be the first collector of butterflies in the Malay Peninsula of whom there is any record, and his journals (1894, *J. Straits Br. R. asiat. Soc.* **26**: 58–201; **27**: 57–133) are of the greatest interest.

Dagobert Karl Daldorff was an officer in the garrison at Tranquebar in 1792 and returned to Denmark the following year. In 1795 he was appointed Captain-Lieutenant at Serampore in Bengal but, on his return to Tranquebar, he proceeded to Sumatra and did not reach Serampore until 1798. It is known that he sent specimens to Fabricius, Banks, Tønder Lund and his patron Sehestedt. It is hardly possible that any of the Daldorff specimens in the Banks Collection can be Fabrician types, however, for Fabricius paid his last visit to England in 1791, the year before Daldorff went to India.[1]

Fabricius visited England in 1767, when he first met Banks, the Hunters, Drury and Lady Anne Monson, and remained during the greater part of 1768. He paid almost annual visits up to 1782, and made further visits in 1787 and 1791. Most of his descriptions were based on specimens in collections other than his own which he inspected during his visits abroad, and it is thus easy to account for some of the rather confused descriptions and for the fact that some species were described several times under different names.

In the lists, the sex of the holotype is given where known, and what is believed to be the true habitat of the type specimens is placed in square brackets.

[1] *Vide* Appendix for a list of the Daldorff specimens in the Banks Collection.

1775, *Systema Entomologiae.*

Capite Bonae Spei : Papilio astenous (p. 448) ♀, [Java].

May have been obtained by Banks in 1770 when the " Endeavour " visited Java. Certainly not from the Cape of Good Hope as stated by Fabricius.

Nova Hollandia : Papilio melania (p. 475) ♀; *P. pomona* (p. 479) ♀; *P. affinis* (p. 511) ♂; *P. perseus* (p. 488) ♂; *P. centaurus* (p. 520) ♀. [All North Queensland.]

As pointed out by Watkins, it is likely that the " Nova Hollandia " specimens were taken during the voyage of H.M.S. " Endeavour " at the future Cooktown in North Queensland during July and August 1770. The specimen which has hitherto been regarded as the type of *centaurus* is a male of the *Arhopala* species described as *nakula* by C. and R. Felder from the Malay Peninsula. This specimen, which is one of two males, was probably obtained by Koenig in the Malay Peninsula or Peninsular Siam (both specimens lack locality labels), and there is every reason for supposing that neither specimen was in the Banks Collection when Fabricius described *centaurus*. Moreover, the original description applies to a female and cannot be fitted to *nakula* satisfactorily. On the other hand, Banks' *nakula* male, together with a male of *Arhopala atosia* (Hew.) also in the Banks Collection, is depicted as " *centaurus* " in Jones' *Icones*, **6**, pl. 22, fig. 1. It is believed that these figures were seen by Fabricius, so it may be assumed that the true *centaurus* was rather similar to *A. nakula*. The original description of *centaurus* fits best the female of *Arhopala eupolis* (Miskin), and it is a reasonable assumption that the type specimen was obtained by Banks in North Queensland when the other " Nova Hollandia " specimens were taken. As *nakula* and *eupolis* are conspecific, *centaurus* can still be employed for the *Arhopala* species which passes under this name.

America Boreali : Papilio pirithous (p. 483) ♀, [South China].

1782, *Species Insectorum*, **2**.

India Orientali : Papilio xiphia (p. 43) ♀; *P. aesopus* (p. 125) ♀; *P. phaedrus* (p. 125) ♂. [All South India].

Probably all taken by Koenig. *P. xiphia* was altered by Fabricius to *P. nina* in 1793 (p. 194).

India : Papilio fabius (p. 12) [South India.]

Probably another of Koenig's specimens.

1787, *Mantissa Insectorum*, **2**.

Siam : Papilio curius (p. 9) ♀; *P. arcesilaus* (p. 28) ♂; *P. cocles* (p. 7) ♂; *P. heliodore* (p. 52) ♂; *P. martha* (p. 56) ♀; *P. cocytus* (p. 29) ♂; *P. allica* (p. 52) ♀; *P. iarbus* (p. 68) ♂. [All Peninsular Siam, Pulau Salang].

All the evidence accords with the view that these specimens were taken near Pulau Salang by Koenig in 1779. It was probably during his visit to England in 1782 that Fabricius named them. The type specimen of *cocles* bears a label " Papilio cocles Fab. Mss. br. fr. Siam by Koenig ", that of *cocytus*

" Papilio cocytus Fab. Mss. in Siam ", and that of *allica* " Papilio allica from Siam Fab. Mss." in what I think is the handwriting of Sir J. Banks.[2]

Puli Candor : Papilio iudith (p. 22) ♂, [Java]; *P. hippia* (p. 55) ♂, [Pulau Condore]; *P. lisias* (p. 65) ♂♀, [Pulau Condore].

The specimen of *iudith*, which has no other label than " P. judith ", agrees precisely with Javanese males and its true habitat cannot be doubted. The *hippia* specimen is labelled " Papilio hippia Fabr. Mss. fr. Poolocond." by Banks, and the type specimens of *lisias* are without locality labels.

It appears likely that the two last-named species are actually from Pulau Condore and were taken by Nelson. The *hippia* male more closely resembles males from Hong Kong and Hainan than those from South Burma which usually pass as *Valeria valeria hippia* (Fab.). The *lisias* specimens have the fore-wing orange-brown band narrower than in *Marmessus ravindra bois-duvali* (Mre.), from South Burma, but more prominent and much broader than ever occurs in specimens of *M. ravindra* (Hsf.) from North Malaya, and they probably represent a distinct race from Pulau Condore.[3]

Cochin China : Papilio peranthus (p. 4) ♂, [Java].

The specimen is labelled " Papilio peranthus Fab. Trojane Mss. Bailey ", and can only have come from Java.

India Orientali : Papilio empedocles (p. 10) [Malaysia]; *P. periander* (p. 9) ♂, [probably Peninsular Siam, Pulau Salang]; *P. gambrisius* (p. 12) ♂, [Pulau Condore].

Although many of Koenig's South Indian plants were labelled " India or.", and the habitat given above by Fabricius suggests Koenig and South India, none of the three names now under consideration can be affixed to butterflies from Peninsular India.

Papilio empedocles occurs with little geographical differentiation in Malaysia, but it is very rare in Malaya, where there is a tendency for the fore-wing post-discal band to be continued to spaces 7 and 1*b* : the type specimen has no spots in these spaces and is possibly of Javanese origin.

The type of *periander* has the fuscous bordering darker and the fulvous colouring in the tornal area of the hind-wing more extensive than is usual in specimens from Peninsular Siam, although it is probable that the specimen in question was taken by Koenig at Pulau Salang.

The type of *gambrisius* is labelled " Bailey gambrisius " and, if taken by Bailey, must have come from Pulau Condore. It is definitely not of Malayan or Javanese origin, but agrees with males of *Parthenos sylvia* (Cram.) from Peninsular Siam and Tonkin.

Africa Aequinoctiala : Papilio licea (p. 20) ♂, [Java].

The description of *licea* can apply to either the Javanese or Niasese form of the *Cepora* species, but the latter locality is too improbable. The description does not fit *Daptonoura flippantha* (Fab.), a female of which is labelled *P. licea* in the *Icones*, **3**, pl. 5, fig. 8.

[2] Other specimens, not types, in the same collection which were probably taken at the same place and time by Koenig are : *Appias nero figulina* (Btlr.) ♀, labelled " Hab. in Siam ", *Cirrochroa tyche mithila* Mre. ♂, " Siam, Koenig ", *C. fasciata fasciata* (C. & R. Feld.), ♀, " Siam, Koenig ", *Euthalia cocytus cocytus* (Fab.) ♀, " From Siam ", and *Taxila thuisto thuisto* Hew., ♂, " Hab. in Siam ".

[3] There are several other butterflies from Pulau Condore in the Banks Collection : *Cirrochroa tyche mithila* Mre. ♀, *Zeltus amasa* (Hew.) (= *etolus* (Fab.), praeocc.), and *Tagiades japetus khasiana* Mre. ♀, are all labelled as having been taken by Nelson : *Appias leis griseoides* Moult. ♂ and *A. lyncida vasava* Fruh. ♂, both without the collector's name and the former without a locality label, probably formed part of the same collection.

1793, *Entomologia Systematica*, **3** (1).

India Orientali : Papilio heliacon (p. 19) ♂, [Java].
In Indiis : Papilio philomela (p. 57) ♀, [Malay Peninsula].

The specimen in the Banks Collection which is labelled as the type of *philomela* is identical with one labelled " Philomele Sumatra " which was taken almost certainly by Daldorff in Sumatra at a date not prior to 1795. The same specimen appears to be figured in Jones' *Icones*, **3**, pl. 46, fig. 1, and it is probable that it was taken by Koenig in the Malay Peninsula in 1778 or 1779 : it cannot have been obtained in Peninsular Siam.

Africa : Papilio erota (p. 76) ♀; *Hesperia phocides* (p. 282) ♀. [Both possibly from Pulau Salang].

The type of *erota*, which is a true *Vindula erota* and not *V. arsinoë* (Cram.), is without locality label : the hind-wing white discal band is entirely sullied and is narrower than in Malayan females, and the inner edge of the fore-wing white band is more sinuate. Females from Tonkin are not quite the same. It is not easy to determine the type locality of *erota*, but it is known that *V. erota* is a montane species south of Peninsular Siam. Of the two most likely habitats, Pulau Salang and Pulau Condore, the latter is improbable and the " *Cynthia erota erota* " ♂ recorded from there by Moulton (1923, *J. nat. Hist. Soc. Siam* **6** : 127) may prove to be *V. arsinoë* (Cram.). *P. erota* is usually regarded as being of Siamese origin and, in fact, Pulau Salang appears to be the most probable habitat.

It is difficult also to fix the true habitat of *phocides*. The type is labelled " Africa aequin. Sm."—obviously incorrect—and agrees better with a female from Peninsular Siam than with specimens from the Malay Peninsula or Borneo. There is no evidence that Fabricius ever saw any butterflies from Borneo. The most reasonable course appears to regard Pulau Salang as the type locality of *phocides*, at all events until sufficient material has been obtained in the British Museum to decide the matter positively.

B. Species Described from the Collection of Lady Anne Monson.

1775, *Systema Entomologiae*.

America : Papilio europa (p. 500) ♂, [South India].

As Lady Anne Monson lived in South India, there is every reason for supposing that her specimens were obtained in this locality. A male in the Banks Collection, almost certainly of South Indian origin, although without locality label, may be the actual type specimen.

C. Species Described from the Drury Collection.

I cannot ascertain from what localities Dru Drury obtained his specimens but, as all his specimens on which Fabrician names were based are figured in Jones' *Icones*, there is little difficulty attached to their determination.

1793, *Entomologia Systematica*, **3** (1).

China : Papilio coon (p. 10) ♀, [Java]; *Hesperia maecenas* (p. 271) ♂, [South-east China].
India : Papilio antiphus (p. 10) [West Java or Sumatra]; *P. astyanax* (p. 13) ♀, [South India]; *Hesperia parrhasius* (p. 289) ♂♀, [South India].

The figure of the male of *parrhasius* in the *Icones* (**6**, pl. 16, fig. 2) accurately depicts the species hitherto known as *Euchrysops contracta* (Btlr.), from South India, the only slight point of disagreement being the more numerous and prominent black submarginal spots on the hind-wing above. The female figured appears to represent the same species. The name *parrhasius* has been applied previously, first to *Everes lacturnus* (Godt.), and then to *Nacaduba nora* (C. Feld.), but it is clear that it must be used for *Euchrysops contracta* (Btlr.). Examination of the male genitalia has confirmed the specific distinctness of *E. contracta* (Btlr.), *E. pandava* (Hsf.) and *E. cnejus* (Fab.) (fig. 1).

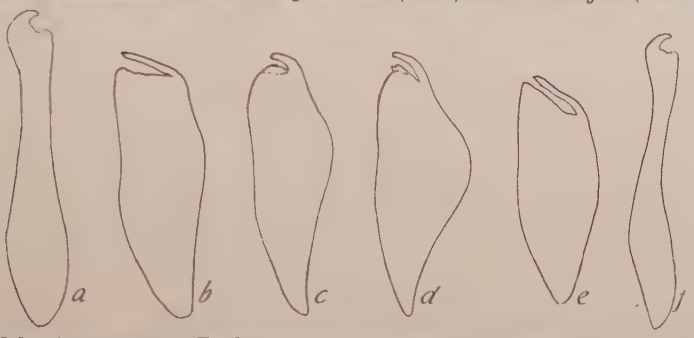

FIG. 1.—Male clasper of (a) *Euchrysops cnejus cnejus* (F.), Central India, Mhow, (b) *E. parrhasius* (Fab.) (=*contracta* (Btlr.)), Central India, Mhow, (c) *E. pandava* (Hsf.) subsp., South India, North Kanara, (d) *E. pandava pandava* (Hsf.), Penang, (e) *E. parrhasius minuta* Evans, North-west India, Peshawar, (f) *E. cnejus cnejus* (F.) form *hapalina* (Btlr.), Central India, Mhow.

Africa : Papilio crino (p. 5) [South India].

Malabaria : Papilio lacedemon (p. 36) [South-east China].

The figure of the type (*Icones*, **1**, pl. 63) agrees exactly with a British Museum specimen from Macao, in which the pale submarginal markings on both surfaces are small and inconspicuous.

In Indiis : Hesperia plato (p. 288) ♀.

From Jones' figure (**6**, pl. 14, fig. 3) I cannot say if the specimen originated from South India as is usually supposed.

(*Habitat not given*) *: Papilio solon* (p. 69) [South India].

Jones' figure (**5**, pl. 63, fig. 2) shows a specimen rather larger than usual in South India and with the underside markings somewhat faint.

D. Species Described from the Jones Collection.

1793. *Entomologia Systematica*, **3** (1).

India : Papilio tulliolus (p. 41) [Queensland].

The figure in the *Icones* (**3**, pl. 67 (err. pro " 69 "), fig. 1) accurately represents the butterfly known as *Euploea tulliolus* Auctt.

(*Habitat not given*) *: Papilio belladonna* (p. 180) ♀.

The habitat is still doubtful as no female has been found which agrees with Jones' figure (**3**, pl. 37, fig. 2). " The original locality may have been Cochin China or Tonkin " (Talbot, 1937, *Mon. Delias* : 284).

E. Species Described from the British Museum.

Although the types of none of the following species are now extant, all four are figured in the *Icones*.

1793, *Entomologia Systematica*, **3** (1).

Asia : Papilio nero (p. 153) ♂; *P. radamanthus* (p. 42) ♂.

It is often difficult to fix positively the habitat of a male of *Appias nero*, but the type (*Icones*, **3**, pl. 85, fig. 2) is generally regarded as being of Javanese origin. The *radamanthus* specimen figured in the *Icones*, **2**, pl. 45, fig. 2, and to which Fabricius referred in his original description, may not be the type as it is labelled " Smith. Hab. —— " : it agrees with examples from Siam or Malaya, but not from Java.

Bengalia : Papilio dirtea (p. 59) ♀.

The type figured (*Icones*, **4**, pl. 65, fig. 1) is smaller than usual in Malayan specimens, and the hind-wing beneath is ochreous with a greenish hue and not bluish-white as in Malaya. It agrees with British Museum females from the Naga Hills in Assam, and there is no reason to doubt the habitat given.

(*Habitat not given*) : *Papilio cyrus* (p. 7) ♀.

The figure in the *Icones* (**1**, pl. [101]) (not cited by Fabricius), which is labelled " Dr. Smith. Hab. —— " and thus may not be the actual type, has a series of red submarginal lunules on both surfaces of the hind-wing, exactly as in a Calcutta female in the Hope Department at Oxford.

F. Species Described by Fabricius Without Mention of Location of Type.

It is possible that the types of two further Fabrician species are in the Banks Collection : they were not found in the Copenhagen Museum.

1775, *Systema Entomologiae*.

Capite Bonae Spei : Papilio medus (p. 488) ♂, [Java].

Banks specimen, which is almost certainly of Javanese origin, is figured in Jones' *Icones*, **6**, pl. 52, fig. 3.

1787, *Mantissa Insectorum*, **2**.

In Indiis : Papilio etolus (p. 66) ♂, [Pulau Condore].

A male in the Banks Coll. is labelled " from Poolocondore Nelson ", and is nearer Hainan males than those from South India or Malaysia. It differs from Hainan males only in the less bluish inner area on the fore-wing beneath and in the smaller black tornal spots on the underside of the hind-wing.

Fruhstorfer (1911, *Berlin. ent. Z.* **56** : 242) considered that the nomino-typical form of *etolus* ranged from Sikkim to Tonkin and Siam. Judging by Moulton's record (1923, *loc. cit.* **6** : 127), it is not uncommon on Pulau Condore.

G. Species Described from the Collections of Lund, Daldorff, Sehestedt and Thott.

I am unable to add much to the information published by Aurivillius

(1898, *Ent. Tidsk.* **18 :** 139–174) on the butterflies described by Fabricius from the larger Danish Collections and of which the types are now in the Copenhagen Museum. It is evident that Tønder Lund, Sehestedt and Thott were all closely associated and probably received specimens from Koenig and Daldorff.

Of the species described from the Collection of Tønder Lund, *Papilio pelea* (1787 : 53) and *P. monina* (1787 : 51) must have been obtained in the Malay Peninsula, although described from " India Orientali," while *P. palinurus* (1787 : 2), *P. cornelia* (1787 : 21), *P. aspasia* (1787 : 15), *P. claudius* (1787 : 25) and *P. panthera* (1787 : 39) were almost certainly obtained on Pulau Salang or in the Malay Peninsula by Koenig, in spite of the habitat " Tranquebariae." It is probable that *P. cocyta* (1793 : 127), from " India Orientali," is also of Malayan origin. *Hesperia democritus* (1793 : 285), whose identity with *Arhopala albopunctata* (Hew.) was established by Corbet (1934, *Entomologist* **67 :** 60), is another insect almost certainly taken by Koenig near Pulau Salang.

The type specimen of *Hesperia atticus* (1793 : 339) at Copenhagen is that described as *Tagiades atticus atticus* by Evans, 1932, *Ident. Ind. Butt.* : 334, but he has discontinued the use of the name as the original description is unsatisfactory. The same may be said of the description of *Papilio atlita* (1787 : 37), from " India Orientali," which cannot be wholly applied to any Indo-Australian butterfly, although Butler's restriction to the Sumatran race of *Terinos atlita* Auctt. (1870, *tom. cit.* : 117, pl. i, fig. 3) may be allowed.

Probably all the species described in 1798 from the Daldorff Collection, with habitat " India Orientali " or " India," were taken by Daldorff in South India. *Hesperia maro* (1798 : 432), of which the type is missing, may be a *Potanthus* species, but Brigadier Evans and I consider it desirable to leave Butler's determination (1870, *tom. cit.* : 279), whereby the name sinks as a synonym of *Ampittia dioscorides* (Fab.).

The description of *Hesperia freja* (1793 : 263) in the Sehestedt Collection suggests Pulau Salang as the probable habitat, and not " Tranquebariae " as given by Fabricius. Another " Tranquebar " species, *Papilio haquinus* 1793 : 55), is evidently Malayan and was probably taken by Koenig.

As the types of *Papilio rosimon* (1775 : 523), *P. alexis* (1775 : 533) and *P. colon* (1775 : 531), from the Collection of Thott, are still extant, it should be possible to improve on the vague habitat " India " given by Fabricius.

I have discussed certain of the species described by Fabricius as having been taken by Koenig in " India Orientali " (1940, *Entomologist* **73 :** 275).

The types, or figures of the type specimens in Jones' *Icones*, of all the Fabrician names mentioned in this paper have been examined with the exception of *Papilio licea*, *P. cornelia*, *P. atlita*, *P. haquinus*, *P. centaurus* and *Hesperia maro*. It is possible that the hitherto unlocated types of *P. europa*, *P. medus* and *P. etolus* are in the Banks Collection. It is doubtful if the specimens figured in Jones' *Icones* of *P. cyrus* and *radamanthus* are the types.

It appears to have escaped notice that the following Fabrician names are homonyms of names of other authors : *Papilio fabius* Fab., 1781 (praeocc. *P. fabius* Cram., 1776), *P. hippia* Fab., 1787 (praeocc. *P. hippia* Cram., 1779), *P. lisias* Fab., 1787 (praeocc. *P. lisias* Cram., 1777), *P. empedocles* Fab., 1787 (praeocc. *P. empedocles* Cram., 1779), *P. periander* Fab., 1787 (praeocc. *P. periander* Cram., 1777), *P. gambrisius* Fab., 1787 (praeocc. *P. gambrisius* Cram., 1777), *P. etolus* Fab., 1787 (praeocc. *P. etolus* Cram., 1779) and *P. philomela* Fab., 1793 (praeocc. *P. philomela* L., 1763). It is unfortunate that *P. perseus* Fab., 1775, was described in the same year as *P. perseus* Cram.

Appendix.

Specimens in the Banks Collection believed to have been taken by D. K. Daldorff.

All the following specimens are labelled in ink in large handwriting which may be that of Daldorff, as it seems that the labels have been cut from envelopes or similar containers. There are several others, almost certainly of Sumatran origin but without labels, which may have been part of Daldorff's Collection.

Papilio helena L. subsp. ♂. Labelled "Heliacon? Astenoides No. 3". The hind-wing has black submarginal spots in spaces 2, 3 and 4 such as often occurs in Javanese ♂♂. None of the few Sumatran ♂♂ examined has these spots, although a Penang specimen appears to be identical. This submarginal spotting is evidently a variable character in Malaysia, and it is not unlikely that the specimen is of Sumatran origin.

Papilio amphrysus ruficollis (Btlr.) ♂. Labelled "Amphrisius? Astenoides No. 2". Agrees with the Sumatran form.

Papilio hector L. Labelled "Hector. Coromandel Bengal".

Papilio memnon anceus Cr. ♂. Labelled "Androgeus Cr. Div. Dald. secund. No. 4".

Papilio memnon anceus Cr. ♀-f. *erebinus* Haase. Labelled "Laomedon Cr. Dald. secund. No. 3". Both the above specimens of *P. memnon* agree with Sumatran examples.

Papilio antiphates itamputi Btlr. Labelled "Alcibides Sumatra". Although the tornal area is damaged on both hind-wings, there is no reason to doubt the habitat given on the label.

Papilio agamemnon agamemnon L. Labelled "Agamemnon Coromandel". The specimen does not agree with South Indian examples, but may be from Sumatra.

Valeria valeria lutescens (Btlr.) ♂. Labelled "Hippia Sumatra Bengal".

Valeria valeria lutescens (Btlr.) ♀. Labelled "Philomele Sumatra". The above pair agree with Sumatran specimens.

Danaus melanippus hegesippus (Cr.) ♀. Labelled "Hegesippus Sum, var. 1".

Danaus aspasia aspasia (Fab.) ♂. Labelled "Aspasia Sumatra". The above two *Danaus* specimens probably came from Sumatra, as stated.

Danaus limniace mutina (Fruh.) ♂. Labelled "Similis Bengal". Probably from Bengal as stated.

Amathusia phidippus eutropius Fruh. ♀. Labelled "Polymnestor Div. Dald. secd. No. 1". Agrees with Sumatran ♀♀.

Amauris phaedon (Fab.) (Det. H. T. G. Watkins.) Labelled "Cyparissias. Ils de France???". This species is confined to Mauritius (formerly known as Île de France), and Madagascar. Probably Daldorff called at Mauritius when travelling between Denmark and India.

Daldorff was not the first collector to send butterflies to Europe from Sumatra, for Cramer, in *Papillons Exotiques*, records the following forms from the west coast of Sumatra:—*Appias lyncida hippo* (Cr.), 1779, *Pap. Exot.* **3**: 4; *Danaus melanippus hegesippus* (Cr.), 1777, *loc. cit.* **2**: 128; *Zeuxidia aurelius aurelius* (Cr.), 1777, *loc. cit.* **2**: 110; *Rhinopalpa polynice polynice* (Cr.), 1779, *loc cit.* **3**: 4. Of the other butterflies described by Cramer from Sumatra, the figure of *Vindula arsinoë* represents the Amboinese form, while *Papilio minos* is a South Indian insect.

BRITISH APHIDIDAE. 1. THE GENUS *PENTATRICHOPUS* BÖRNER (HEMIPTERA)

PART 1.

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(With 9 Text-figures.)

I. Introduction.

In British and American literature the generic nomenclature of the group of aphides to which *Pentatrichopus* Börner (1932) belongs is very confused. Van der Goot's (1915) genus *Capitophorus* is clearly defined. Confusion has arisen through the tendency of authors to include in this genus most aphides having capitate hairs without due regard to van der Goot's definition of the genus which is as follows :—" Body oval, in apterae partly or wholly covered with capitate hairs. Antennae usually about as long as the body, segment III in apterae without sensoria, segment I with a hornlike projection on the inner side. Frontal tubercles not well developed and without hornlike process. Cornicles long, thin, cylindrical or slightly smaller distally, skin imbricated. Cauda small, cone or club shaped and at most $\frac{1}{3}$ length of cornicles." *C. tetrarhodus* Walker is the only species included by van der Goot which is not recognised as a *Capitophorus* by Börner. *C. flaveolus* Walker is van der Goot's genotype, and this species and *C. hippophaes* Koch are regarded by Börner as belonging to *Capitophorus* proper on account of the presence of long capitate hairs on the head and posterior end of the body only. *C. braggi* Gill. and *C. similis* v. d. Goot he places in the subgenus *Capitophorinus* Börner, in which long capitate hairs occur all over the body.

The genus *Myzus* van der Goot is closely allied to *Capitophorus*; it differs from it chiefly in having sensoria on antennal segment III in apterae and in the antennae being longer than the body. Börner does not recognise this genus, and of the three European species it contains, he places *M. ribis* L. and *M. galeopsidis* Kalt. in the genus *Cryptomyzus* Oestlund, and the third species *M. glandulosus* Kalt. in the genus *Pleiotrichophorus* Börner. This genus, like *Capitophorus*, has Eleagnaceae as winter host plants.

Cryptomyzus Oestlund is still farther removed from *Capitophorus* van der Goot by Börner. He places the former in the group Liosomaphidae (having four spinal hairs on the pronotum), the latter in *Macrosiphea* (having only two spinal hairs on the pronotum). This separation of two big groups mainly on the presence or absence of spinal hairs on the pronotum is typical of Börner's views regarding the importance of chaetotaxy in the family Aphididae.

On morphological and biological grounds it is clear that the genera *Cryptomyzus*, *Pentatrichopus*, *Capitophorus*, and *Pleiotrichophorus* are distinct and it must be accepted that many genera with capitate hairs have a polyphyletic origin. On the other hand, the possibility of the above genera being a monophyletic group cannot be entirely disregarded. The primary host-plants of *Cryptomyzus* and *Pentatrichopus* are Rosaceae and those of *Capitophorus* and *Pleiotrichophorus* are Eleagnaceae; these two plant families belong to the orders Rosales and Myrtiflorae respectively and are by some authors regarded as being closely allied.

II. General Morphology and Biology.

The genus *Pentatrichopus* Börner is clearly defined. The first tarsal joints of adults have five hairs (fig. 1); the cornicles are comparatively long and thin; the antennae in apterae are devoid of secondary sensoria; the head generally possesses distinct frontal tubercles; the body in apterae is covered with long, knobbed hairs on distinct basal papillae; there are two spinal hairs on the pronotum; young larvae have pleural hairs present from the second thoracic to the fifth abdominal segment; there is no seasonal change of host, which is always a member of the Rosaceae.

The body is generally egg-shaped. The apterous forms, with the exception of the males, vary in colour from very pale yellow to pale green; they generally have a translucent appearance and there are no body markings. The alatae have a delicate fragile appearance, the head and thorax are dark and there is a characteristic dark patch on the abdomen, extending from the first or second segment to about the level of the cornicles. In all forms except the apterae of *P. tetrarhodus* the head possesses distinct frontal tubercles, which are more prominent in *P. potentillae* than in other species. It also bears a number of capitate hairs which are longer and more conspicuous in apterae. The antennae are of six segments generally shorter than the body or only a little longer. In apterae they are devoid of secondary sensoria; in alatae these may occur on III only or on III and IV. They bear a varying number of short capitate hairs particularly on the basal segments. The rostrum is short and thick with a dark tip, extending to the third coxae, the last segment tends to be blunt. The thorax is normal and has two spinal hairs on the pronotum, the thoracic hairs are strongly capitate in apterae and simple in alatae. The legs are moderately long and thin, the coxae are generally imbricated and the first tarsal joints are always five haired.

The abdomen in apterae has a characteristic rugged appearance due to a wrinkling of the integument and to the presence of the tubercles which bear long capitate hairs (fig. 2). They are present on all segments except the ninth, and are arranged in six longitudinal rows; two median rows bearing the spinal hairs; two lateral rows bearing the marginal hairs; and two intermediate rows bearing the pleural hairs. Each tubercle may bear one, two, or three capitate hairs and occasionally some short ones (*e.g.* the males of *P. tetrarhodus*). There may be additional small, capitate hairs borne independently of these tubercles. Ventrally the abdomen bears transverse rows of rather short and fine non-capitate hairs. In the alatae and fundatrices the capitate hairs are shorter and less numerous than in the apterous viviparous females.

The average length of body hairs (apt. viv. ♀♀) in *P. fragariae* and *P. potentillae* is 0·05 mm., and in *P. tetrarhodus* 0·08 mm. The proportion of hair length to body length in *P. fragariae* is 1 : 23 to 1 : 33; in *P. potentillae* 1 : 33 to 1 : 38 and in *P. tetrarhodus* 1 : 16 to 1 : 18. This gives an indication of the microscopical appearance of the species, *P. tetrarhodus* appearing much more hairy than either *P. fragariae* or *P. potentillae*. The imbricated cornicles are rather long and thin, but are considerably shorter in *P. tetrarhodus* than in the other species; the imbrications are more conspicuous basally. In *P. fragariae* and *P. potentillae* they are borne on the middle of abdominal segment 5 but in *P. potentillae* they are borne on the posterior margin of this segment. In the living insect they are pale and tend to be translucent, the base is only slightly expanded and there is a marked flange at the distal end. The cauda is comparatively long and conical, slightly constricted basally and normally bears 5–7 hairs (two or three pairs and a subapical); it has a distinctly spiny appearance.

The genus contains the three British species *P. tetrarhodus* Walker, *P.*

potentillae Walker, and *P. fragariae* Theobald. Börner (1932) includes in this genus the species *P. tetrarhodus*, *P. fragaefolii* Cockerell, and *P. brevipilosus* Baerg. He places *P. fragariae* as a synonym of *P. fragaefolii*, and states that the position of *P. potentillae* is uncertain but it may be a synonym. *P. brevipilosus* is a North American species.

The general biology of members of the genus has been studied by Thomas and Jacob (1940). The biology of *P. fragariae*, because of its importance as a vector of virus diseases of strawberries, has received far more attention than the other species. *P. fragariae* overwinters mainly as apterous viviparous females, *P. tetrarhodus* and *P. potentillae* overwinter as eggs. The host-plants are always Rosaceae. Alatae occur in June and a few in the autumn but there is no change of host-plants. Fundatrices and males (of the species here described) are apterous. The males of *P. fragaefolii* are alate.

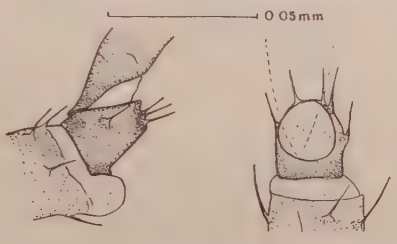

Fig. 1.—First tarsal joint showing typical chaetotaxy of the genus. Left, side view; right, lateral view.

III. Key to Species and Table of Measurements.

Key to apterous viviparous females.

1(4). 5 caudal hairs. Small nodules on head. Pleural and marginal tubercles generally with a single long capitate hair in each abdominal segment. Antennal segments IV and V together about $1\frac{1}{4} \times$ III. Cornicles = $2\frac{1}{2}$–$3\frac{1}{2} \times$ cauda. Average length of capitate hairs on body = $\frac{1}{6}$–$\frac{1}{8} \times$ cornicle. Antennal segment III approximately equal to or greater than width of head in constriction just in front of eyes. Length of ultimate rostral segment $1\frac{1}{2} \times$ its basal width.

2(3). At least 1 distinctly capitate hair on each trochanter. A large number of nodules on head and antennal segment I. At least 7 distinctly capitate hairs on antennal segment III, the longest of which are longer than the diameter of antennal segment IV. A row of capitate hairs on abdominal segments 1–4 between pleural and marginal hairs. On *Potentilla anserina* L. . . . . *P. potentillae* (Wlk.).

3(2). Hairs on trochanter rarely capitate. Nodules on head, but very few on antennal segment I. Less than 7 distinctly capitate hairs on antennal segment III, the longest of which are generally shorter than the diameter of antennal segment IV. No additional hairs between pleural and marginal rows on abdomen. On cultivated strawberries, rarely on wild Rosaceae . . . . . *P. fragariae* (Theob.).

4(1). More than 5 hairs on cauda. Head without nodules. Pleural hairs absent on abdominal segment III. Marginal tubercles on abdomen generally have more than one hair. Antennal segments IV and V together only slightly longer than III. Cornicles only slightly longer than cauda. Capitate hairs on body $\frac{1}{3}$–$\frac{1}{2} \times$ cornicle. Antennal segment III about $\frac{2}{3}$ width of head in constriction just in front of eyes. Length of ultimate rostral segment rather more than twice its basal width. On *Rosa* spp. . . . . *P. tetrarhodus* (Wlk.).

Key to alate viviparous females.

1(4). 5 caudal hairs. Antennal segment III shorter than segments IV and V together. Cornicles about $2\frac{1}{2} \times$ cauda.

2(3). Sensoria on antennal segment III only. Capitate hairs on body very short. A row of capitate hairs on abdominal segments 1–4 between pleural and marginal hairs . . . . . *P. potentillae* (Wlk.).

3(2). Sensoria on the 4th antennal segment. Some spinal hairs on the abdomen are long. No additional hairs between pleural and marginal rows on abdomen . . . . . *P. fragariae* (Theob.).

4(1). More than 5 caudal hairs. Antennal segment III is longer than IV and V together. Cornicles about $1\frac{1}{2} \times$ cauda . . *P. tetrarhodus* (Wlk.).

TABLE I.

Maximum and minimum measurements in millimetres of apterous viviparous females.

	P. fragariae		*P. potentillae*		*P. tetrarhodus*	
	Max.	Min.	Max.	Min.	Max.	Min.
Body	1·76	1·15	1·92	1·75	1·45	1·32
Antenna	1·60	1·13	1·75	1·52	0·80	0·73
III of antenna . .	0·33	0·28	0·44	0·37	0·22	0·17
Cornicle	0·39	0·32	0·46	0·40	0·21	0·18
Cauda	0·12	0·10	0·17	0·13	0·16	0·15
Width of head . .	0·27	0·25	0·34	0·28	0·28	0·26
Body hairs (average) .	0·05		0·05		0·08	

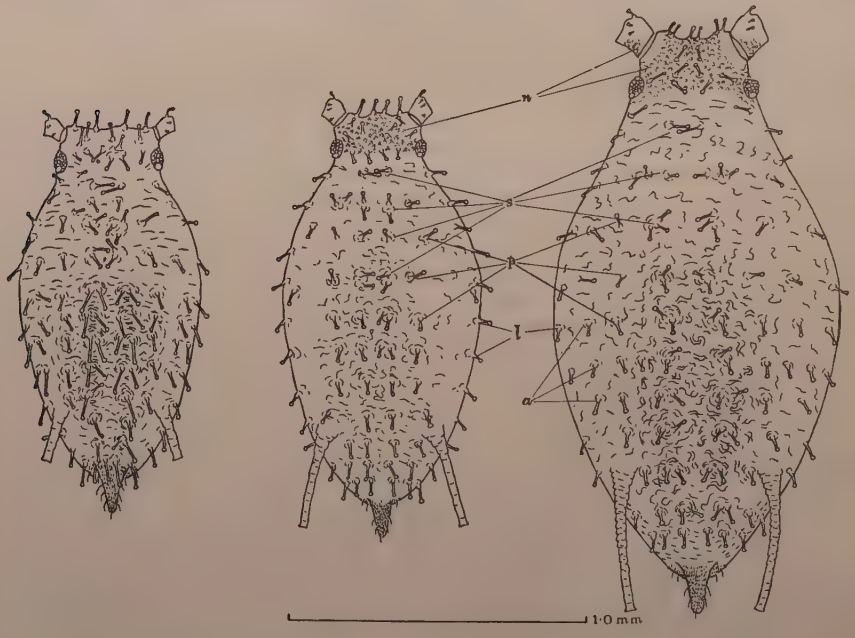

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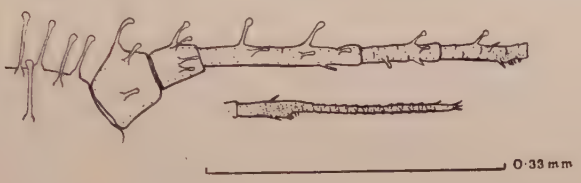
FIG. 2.—Left, centre and right, dorsal views of bodies of apt. viv. ♀♀ of *P. tetrarhodus* Wlk., *P. fragariae* Theob., and *P. potentillae* Wlk. respectively. s = spinal hairs; p = pleural hairs; l = lateral hairs; a = additional row of hairs in *P. potentillae* Wlk.; n = nodules on head and base of antenna.

Table II.

Selection of relative proportions from Table I.

	P. fragariae		*P. potentillae*		*P. tetrarhodus*	
	Max.	Min.	Max.	Min.	Max.	Min.
Corn. : III [1]	1 : 1$\frac{1}{5}$	1 : $\frac{9}{11}$	1 : 1—	1 : 1—	1 : 1	1 : 1
Cauda : III	1 : 2$\frac{3}{4}$	1 : 2$\frac{1}{3}$	1 : 2$\frac{2}{3}$	1 : 1$\frac{3}{8}$	1 : 1$\frac{3}{8}$	1 : 1$\frac{1}{8}$
Hair : III	1 : 6$\frac{2}{5}$	1 : 5	1 : 9	1 : 7$\frac{2}{3}$	1 : 2$\frac{3}{4}$	1 : 2$\frac{1}{4}$
Head : III	1 : 1$\frac{1}{4}$	1 : 1+	1 : 1$\frac{1}{3}$	1 : 1$\frac{1}{3}$	1 : $\frac{6}{7}$	1 : $\frac{6}{7}$
Hair : Corn.	1 : 8	1 : 6	1 : 9	1 : 8	1 : 2$\frac{3}{4}$	1 : 2$\frac{1}{4}$
Hair : Cauda	1 : 2$\frac{2}{5}$	1 : 2	1 : 3$\frac{2}{5}$	1 : 2$\frac{2}{5}$	1 : 2	1 : 2
Hair : Body	1 : 33	1 : 23	1 : 38	1 : 33	1 : 18	1 : 16
Cauda : Corn.	1 : 3$\frac{1}{4}$	1 : 3$\frac{3}{10}$	1 : 2$\frac{4}{5}$	1 : 3	1 : 1$\frac{1}{4}$	[1] 1 : 1$\frac{1}{5}$

[1] III = 3rd segment of antenna.



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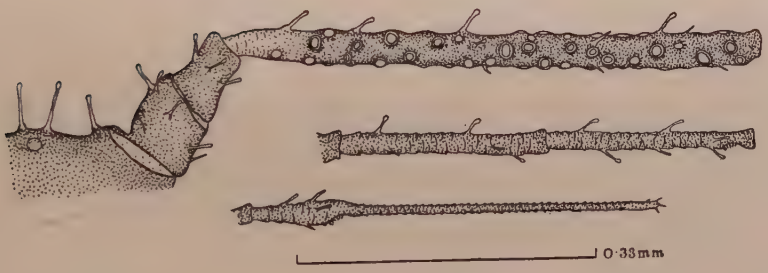

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Fig. 3.—Antenna of *P. tetrarhodus* Wlk., apt. viv. ♀.
Fig. 4.—Antenna of *P. tetrarhodus* Wlk., alate viv. ♀.

IV. Description of Species.

Pentatrichopus tetrarhodus (Walker, 1849) (figs. 2, 3, 4).

1849, *Aphis tetrarhoda* Walker, F., *Ann. Mag. nat. Hist.* (2) **4** : 42.
1857, *Siphonophora rosarum* Koch, C. L., *Pflanzenläuse Aphiden* : 180–182.
1876, *Siphonophora rosarum*, Buckton, G. B., *British Aphides* **1** : 150–151.
1915, *Capitophorus tetrarhodus*, Goot, P. v. d., *Beitr. Holl. Blattl.* : 128–131.
1915, *Myzus neorosarum* Theobald, F. V., *Bull. ent. Res.* **6** : 111.
1915, *Myzus tetrarhodus*, Theobald, F. V., *Bull. ent. Res.* **6** : 129.
1926, *Capitophorus tetrarhodus*, Theobald, F. V., *Aphid. Great Britain* **1** : 241–242.
1926, *Capitophorus neorosarum*, Theobald, F. V., *Aphid. Great Britain* **1** : 248–250.
1932, *Pentatrichopus tetrarhodus*, Börner, C., *in* Sorauer: *Handb. PflanzenK.*, 4th ed., **5** (2) : 619.
1933, *Pentatrichopus tetrarhodus*, Lambers, D. H. Ris, *Stylops* **2** : 173.
1940, *Pentatrichopus tetrarhodus*, Thomas, I., and Jacob, F. H., *Ann. appl. Biol.* **27** : 234–247.

Apterous viviparous female.—Colour of living specimen: Head, thorax, and abdomen pale yellow green to dark green. Eyes very dark red. Antennae pale yellow except for areas around primary sensoria and extreme tips which are dusky. Legs colour of body with tips of tibiae and tarsi darker. May be very slightly mealy.

Macerated specimen: Body oval with dorsal integument characteristically wrinkled. Body hairs long and capitate (fig. 2, A), averaging 0·08 mm., placed on basal tubercles. All the spinal tubercles with the exception of the prothoracic and sometimes the sixth abdominal and occasionally one of the seventh with two hairs. Pronotum typically with two spinal hairs. Pleural hairs occur singly and are present from the second thoracic to the sixth abdominal segment; they are absent from the seventh and occur again on the eighth. Marginal tubercles generally with more than one capitate hair. Head; frontal tubercles absent, no head nodules as in *P. fragariae* Theob. and *P. potentillae* Wlk. Antennae (fig. 3) about half as long as body with no secondary sensoria. I and II with no prominent markings, each bearing 4 capitate hairs, in addition I bears a single small non-capitate hair and has a forwardly projecting protuberance on the inner side. III slightly imbricated distally with about 7 to 11 capitate hairs, at least two of which are generally longer than diameter of the segment. IV and V slightly imbricated, each bearing about 4 hairs, at least two being capitate. Rostrum reaches third coxae. Cornicles cylindrical, slightly imbricated, slightly expanded basally and with a small but distinct flange; generally very slightly longer than cauda and about $\frac{1}{7}$ to $\frac{1}{8}$ of length of body, borne on the middle of abdominal segment V. Cauda conical, spiny and bearing 7 to 8 caudal hairs, at least 3 lateral pairs and a dorsal hair, generally slightly shorter than cornicles. Anal plate spiny like the cauda and bearing 7 or 8 long non-capitate hairs. Genital plate with about 9 moderately long non-capitate hairs. Legs: coxae imbricated, coxae and trochanters without capitate hairs; femora very slightly imbricated distally on one side and with a number of blunt or weakly capitate hairs. Tibiae of first and second legs with weakly capitate hairs and several non-capitate hairs distally. Hind tibiae (fig. 5, C) with a number of prominent capitate hairs equal to about $\frac{3}{4}$ diameter of tibia. Tarsi imbricated, first tarsal joints with 5 hairs.

Measurements of one specimen: Length of body (including cauda) 1·33 mm., breadth of body 0·60 mm., antenna 0·73 mm., cornicle 0·18 mm., cauda 0·16 mm., width of head 0·26 mm., average length of body hairs 0·08 mm., antennal segments $\frac{0{\cdot}07}{\text{I}}$; $\frac{0{\cdot}06}{\text{II}}$; $\frac{0{\cdot}18}{\text{III}}$; $\frac{0{\cdot}09}{\text{IV}}$; $\frac{0{\cdot}09}{\text{V}}$; $\frac{0{\cdot}06+0{\cdot}18}{\text{VI}}$ mm. Secondary sensoria absent.

Alate viviparous female.—Colour of living specimen: Head and thorax black with a pale green band between the pro- and meso-thorax. Abdomen green with a large patch dorsally, which generally includes most of segments 3, 4 and 5, and the pleural hair-bearing tubercles laterally. Segment 2 has a median broken dark band and on segment 1 there are 4 small dark patches. There are emarginated narrow dark bands on segments 6 and 7 and a broken band on 8. There are lateral dusky patches on segments 2, 3, 4, 6 and 7, and dusky patches around the bases of the cornicles. All these markings are slightly variable. Eyes very dark red. Cornicles almost black. Cauda green. Integument translucent. Ventral surface: thorax black, base and tip of rostrum dusky. Antennae black with I and II and base of III lighter. Legs green with the exception of the coxae and the tips of the femora, tibiae and tarsi, which are almost black. Wing venation prominent.

Macerated specimen: Markings as in living specimen. Body oval. Body hairs shorter and much less conspicuous than in apt. viv. ♀ but more conspicuous than in alatae of *P. potentillae* and *P. fragariae*. Each spinal tubercle bears, as a rule, two capitate hairs and each pleural tubercle a single capitate hair. Marginal tubercles on segments 1 to 6 bear 2 weakly capitate hairs. The head bears 4 fairly long capitate hairs on the front, 2 median and one on each frontal tubercle and about 6 very small weakly capitate hairs dorsally.

Frontal tubercles distinct but very small. There are a few very small capitate hairs on the thorax. Antennae (fig. 4) about ¾ length of body. I with about 4 weakly capitate hairs and 1 small non-capitate hair. II with about 4 weakly capitate hairs. III slightly imbricated with 40–57 sensoria and about 11 blunt or weakly capitate hairs, about 5 of which are almost equal in length to diameter of III. IV and V imbricated and each bearing about 5 blunt hairs, and 1 or 2 pointed hairs. VI imbricated with about 3 blunt hairs on its basal portion. Cornicles cylindrical and slightly imbricated. Cauda with at least 6 hairs, usually 7 as in apt. viv. ♀, occasionally 8. Legs with coxae slightly imbricated, trochanters without capitate hairs. Femora slightly imbricated distally on one side and without conspicuous capitate hairs. Tibiae fairly hairy, capitate hairs not conspicuous. Tarsi imbricated, normal. Wings with costal and cubital veins very slightly dusky. Stigma imbricated. Basal cells not imbricated but other cells with slight imbrications becoming most numerous distally. Hamula dark. Cubitus, hook and oblique veins in hind-wing dark, otherwise clear with slight imbrications most numerous along the posterior margin.

Measurements of one specimen: Length of body (including cauda) 2·06 mm., breadth of body 0·92 mm., antenna 1·61 mm., cornicle 0·25 mm., cauda 0·17 mm., wing span 5·0 mm., antennal segments $\frac{0{\cdot}08}{\text{I}}$; $\frac{0{\cdot}09}{\text{II}}$; $\frac{0{\cdot}58}{\text{III}}$; $\frac{0{\cdot}23}{\text{IV}}$; $\frac{0{\cdot}23}{\text{V}}$; $\frac{0{\cdot}10+0{\cdot}30}{\text{VI}}$ mm. Secondary sensoria on III, 51 and 54.

Fundatrix.—Colour of living specimen: Head and body pale yellowish-green. Eyes dark red. Cornicles and cauda paler than body. Antennae pale except for areas around the primary sensoria and extreme tips which are dusky. Tip of rostrum dusky. Legs pale with tips of tibiae and tarsi darker.

Macerated specimen: Much less rugged in appearance than the apterous viviparous female, due to its larger-sized body and comparatively shorter hairs. Rostrum to second coxae. Antennae little more than half as long as body with no sensoria. I and II as in apterous viviparous female. III slightly imbricated with about 9 capitate hairs, at least three of which are equal to ¾ diameter of III; IV imbricated and with about 8 hairs ranging from capitate to non-capitate. V like IV but with about 6 hairs. VI imbricated, basal part usually with 3 blunt hairs. Cornicles and cauda comparatively longer than in apterous viviparous female, the latter with 7 hairs, three lateral pairs and one sub-apical. Legs: coxae imbricated with several short non-capitate hairs. Trochanters without capitate hairs or at most with blunt hairs. Femora slightly imbricated distally on one side, with several short hairs, most of which are weakly capitate or blunt. Tibia with capitate hairs which are not very prominent and generally shorter than half diameter of tibia. Tarsi imbricated, first tarsal joint with 5 hairs.

Measurements of one specimen: Length of body (including cauda) 2·47 mm., breadth of body 1·20 mm., antennae 1·40 mm., cornicle 0·37 mm., cauda 0·23 mm., length of body hairs 0·05–0·06 mm., antennal segments $\frac{0{\cdot}10}{\text{I}}$; $\frac{0{\cdot}09}{\text{II}}$; $\frac{0{\cdot}42}{\text{III}}$; $\frac{0{\cdot}23}{\text{IV}}$; $\frac{0{\cdot}21}{\text{V}}$; $\frac{0{\cdot}11+0{\cdot}24}{\text{VI}}$ mm.

Oviparous female.—Colour of living specimen: Pale yellowish-green to fairly dark green with sometimes a semitranslucent appearance. Eyes very dark red. Antennal joints I and II pale, remainder dusky. Legs dirty white with tips of femora and tibiae (whole hind tibiae) and tarsi dusky. Cornicles translucent. Cauda like body. Tip of rostrum dusky. Mature specimens often shiny when full of eggs. Sometimes slightly mealy and generally much less rugged in appearance than apterous viviparous females.

Macerated specimen: General appearance varies owing to the fact that in some specimens the capitate hairs are all rather short: these hairs arranged as in apterous viviparous female but very variable. When several capitate hairs occur in the same tubercle one is generally longer than the others. Antennae much as in apterous viviparous female. Cornicles cylindrical and slightly imbricated. Cauda with 7–9 long hairs. Hind tibiae

(fig. 5, F) very slightly swollen with 35–45 pseudo-sensoria extending over the greater part of its length.

Measurements of one specimen: Length of body (including cauda) 1·33 mm., breadth of body 0·70 mm., antenna 0·79 mm., cornicle 0·19 mm., cauda 0·13 mm., average length of body hairs 0·08 mm., head hairs 0·06 mm., very variable; antennal segments $\frac{0{\cdot}06}{\text{I}}$; $\frac{0{\cdot}05}{\text{II}}$; $\frac{0{\cdot}19}{\text{IV}}$; $\frac{0{\cdot}10}{\text{V}}$; $\frac{0{\cdot}08+0{\cdot}21}{\text{VI}}$ mm. Secondary sensoria absent.

Egg: laid mainly on woody stems, on bases of thorns and in axils of buds.

Apterous male.—Colour of living specimen: Conspicuously marked. Head black, body olive green with dark bands on each segment; these fused dorsally on the meso- and meta-thoracic and first abdominal segments and on the other abdominal segments generally fused in the pleural region. Tubercles tend to be clear, giving a translucent appearance. Eyes very dark red. Antennae black, I and II and base of III lighter. Coxae and rest of legs except bases of femora dusky. Cornicles light. Ventral surface olive green and slightly mealy. Tip of rostrum, external genitalia and anal plate dark. Cauda lighter.

Macerated specimen: Body comparatively small. Markings as in living specimen. Chaetotaxy as in apterous viviparous female but due to small size of basal tubercles the hairs appear to be longer. Antennae shorter than body, I and II as in apterous viviparous female, III slightly imbricated with 8 to 12 small secondary sensoria and about 9 variable hairs at least one of which is about equal to diameter of III. IV imbricated with 6 or 7 blunt hairs and 0–2 sensoria, V like IV with 3 or 4 secondary sensoria. VI imbricated with 3 hairs on base. Cornicles cylindrical and slightly imbricated. Cauda with 7 hairs. Legs with coxae slightly imbricated. Coxae and trochanters without capitate hairs. Femora with slight imbrications on one side distally. Tibiae all with blunt to capitate hairs on proximal half, these most conspicuous in hind tibiae. Tarsi imbricated, typical.

Measurements of one specimen: Length of body (including cauda) 1·30 mm., breadth of body 0·60 mm., antenna 1·06 mm., cornicle 0·19 mm., cauda 0·10 mm., average length of hairs 0·06 mm. on head, 0·08 mm. on body, antennal segments $\frac{0{\cdot}07}{\text{I}}$; $\frac{0{\cdot}06}{\text{II}}$; $\frac{0{\cdot}32}{\text{III}}$; $\frac{0{\cdot}15}{\text{IV}}$; $\frac{0{\cdot}15}{\text{V}}$; $\frac{0{\cdot}08+0{\cdot}23}{\text{VI}}$ mm. Secondary sensoria; 9 and 10 on III, 0 and 1 on IV, 4 and 4 on V.

Biology: Does not appear to be a common species. Found on *Rosa rugosa* Thunb. at Bangor. Börner (1932) gives "wild and cultivated roses and especially *R. rugosa*" and Theobald (1926) "wild and cultivated roses." The eggs hatch in March and April and alatae occur in May and June. By midsummer apterae are generally very numerous and cluster on the young shoots and leaves. Sexuales are produced in September and October, the apterous males appear to be rare, possibly because they are rather difficult to detect. In experimental inoculations the species lived readily on wild and cultivated strawberries (Thomas and Jacob 1940).

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——. 1936, New species of Coccidae, *Trans. R. ent. Soc. Lond.* **84** : 901–936.

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TO BE HELD IN THE SOCIETY'S ROOMS

41, Queen's Gate, S.W.7

1941.

WEDNESDAY, October 1
" November 5
" December 3

1942.

" January 21 (ANNUAL MEETING)
" February 4

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